External Memory Programmer

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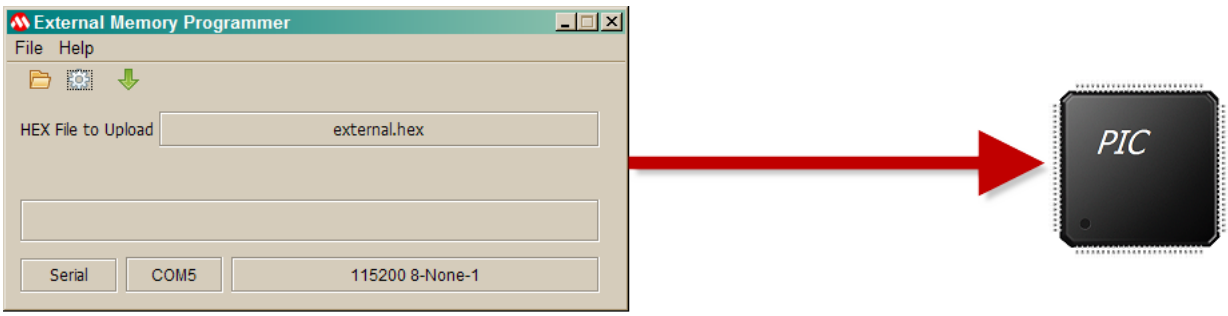
1 Introduction



The External Memory Programmer is a multi-platform utility used to transfer HEX file information to a device. The device will load the transferred information into a memory device. While the memory device is usually an external memory device, like SPI NOR flash, it can be the internal memory of the device. The External Memory Programmer can use two communication mediums to transfer data, serial or USB.

The utility uses a binary communication protocol which allows the device to dictate the maximum payload size up to 65,000 bytes. This allows an independency between devices that have limited resources and the utility.

While this utility was designed for uploading HEX files from the Graphics Resource Converter utility, it will upload any HEX file in Intel 380 format.

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3 Release Notes

Microchip External Memory Programmer

This application is based on the JAVA programming language. To effectively run this program, the computer must have JRE6 installed.

Version 2.3.7

Features

1. Increased the through put speed by reducing the file I/O access.

Version 2.3.2

Bug Fixes

1. Corrected HEX file reading error.

Features

1. New settings dialog box.
2. Able to set the communication timeout.
3. Able to filter USB devices based on the VID and PID.
4. Stop uploads safely.

Version 1.00.01

Bug Fixes

1. USB Drivers
    1. Placed the USB drivers needed for the application under the <install directory>/Microchip/Utilities/USB Drivers/MPLABComm
    2. Using version 2 of the WindowUSB drivers.
2. USB INF file
    1. Placed the USB drivers needed for the application under the <install directory>/Microchip/Utilities/USB Drivers/MPLABComm/Windows
    2. The INF file name has been changed to MPLABCommWinUSB.inf
3. Serial Libraries
    1. The serial libraries have been placed in their own directory <install directory>/microchip/graphics/bin/memory_programmer/Serial Drivers

2. The correct serial driver will be copied into the same directory as the memory_programmer JAR file
    1. It is important that the serial driver directory be in the same directory as the memory_programmer JAR file.
3. Support for 64-bit Windows 7

Version 1.00

Initial JAVA version

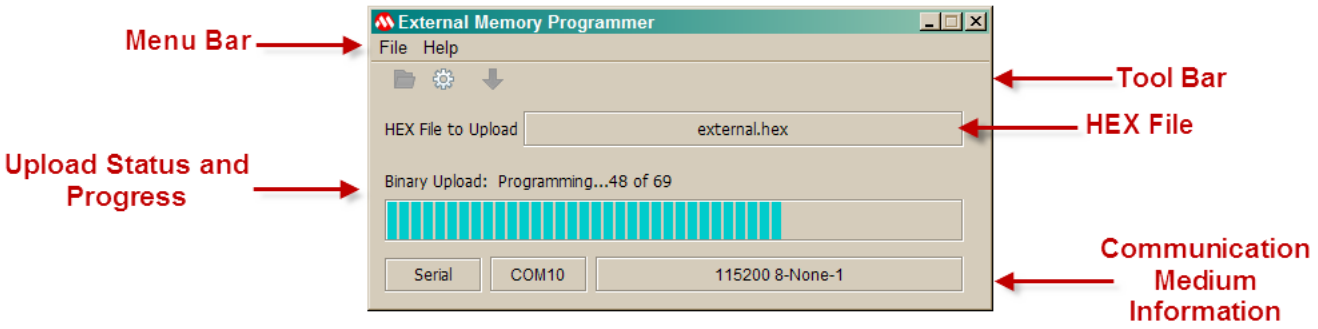
Features

1. Multi-communication support
    1. USB - uses the same drivers as MPLAB X
    2. Serial - uses the rxtx JAVA serial libraries (rxtx.org)
2. Binary file transfer - The HEX file is converted into binary packets
3. Communication protocol - header with checksum and ACK/NACK response
4. File upload verification
5. Drag and drop of the HEX file
6. Progress bar with status

Limitations

1. Using serial communication on the Mac OS X may be slower than running on a Windows machine. It is recommended that USB communication medium be used.

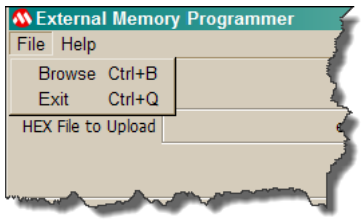
4 User Interface



4.1 Menu Bar

The menu bar can be used to load HEX files, exit the programmer, or launch the about window.

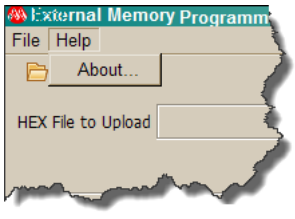
File



Browse - Loads a HEX file to be uploaded to a device.

Exit - Quits the application.

Help

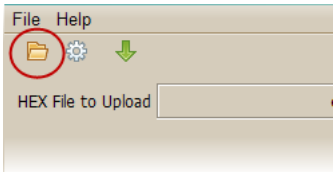


About... - Opens the About window.

4.2 Tool Bar

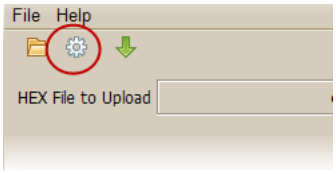
The tool bar button are used to load a Hex file, configure the communication medium and upload the HEX file.

Browse



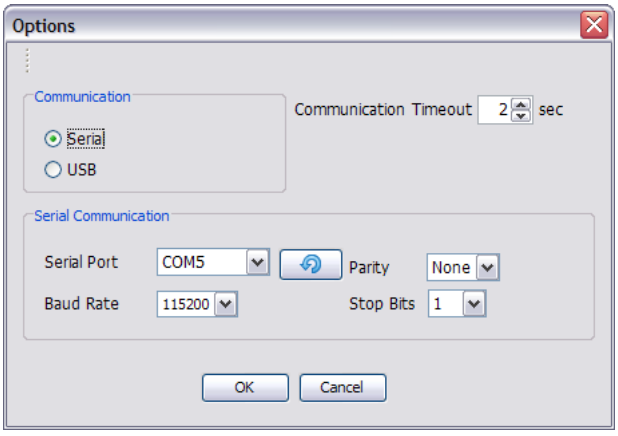
Opens a file dialog box, which allows the user to choose a HEX file to be uploaded.

Communication Settings



Opens a dialog box, which allows the user to select the type of communication, serial or USB, and specific communication settings.

Serial Communication - Uses RS-232 communication.



Serial Port - The serial port number (COM<x>) that will be used to communicate to the device.

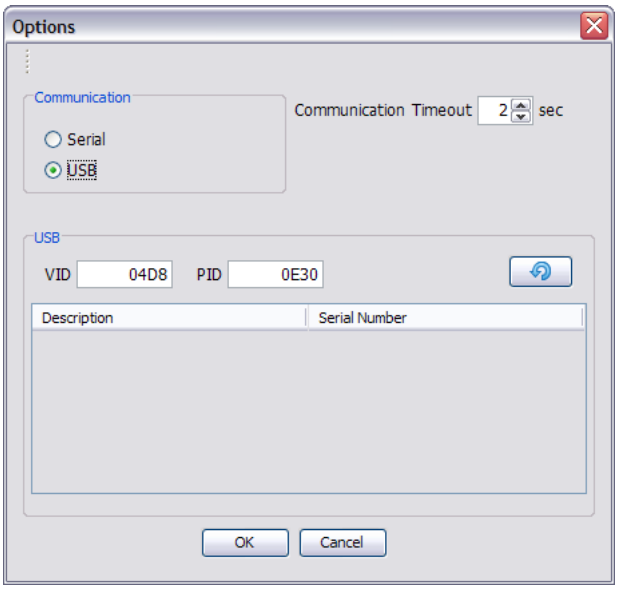
Baud Rate - The baud rate used to communication to the device.

Parity - The parity used.

Stop Bits - The length of the stop bits used.

NOTE: The serial settings must be the same settings as the device.

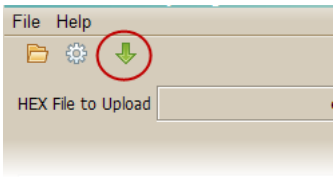
USB



List Box - If there are any USB devices which match the product and vender ID associated with the External Memory Programmer, a list of the serial numbers will be present. The user must select the serial number of the device to communicate to.

NOTE: The device should have a serial number and the correct product and vendor ID. Please refer to the External Memory demo in the MAL for the correct information.

Upload

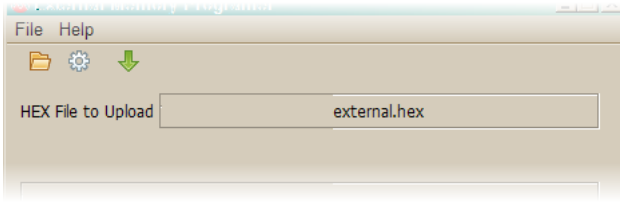


Uploads the HEX file to the device. The button is only enabled after a HEX file and communication settings have been configured.

4.3 HEX File

The uploading HEX file edit box indicates the name of the HEX file to upload. Hovering over the file edit box will display the absolute path of the HEX file, provided one is loaded.

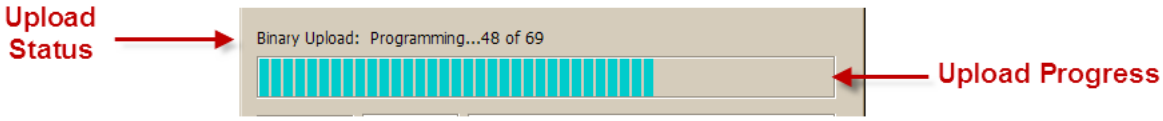
HEX File Box



This displays the current HEX file name. By hovering over the file name, the absolute file path will be displayed. The file box also serves as a drag and drop location for HEX files.

4.4 Upload Status and Progress

When uploading a HEX file, the current status will be display along with a progress bar. This can be used to indicate the amount of data that has been transferred.



Upload Status

The upload status displays the current status of the communication to the device. Some of the messages that are displayed are:

- Binary Upload: Sending ECHO
- Binary Upload: Getting Max packet Size
- Binary Upload: Erasing Memory
- Binary Upload: Programming.....<x> of <y>
- Binary Upload: Verifying...<x> of <y>

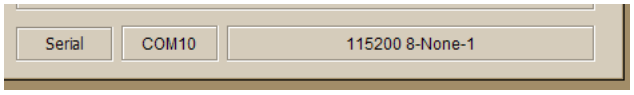
Where <x> is the current packet and <y> is the total number of packets to be sent

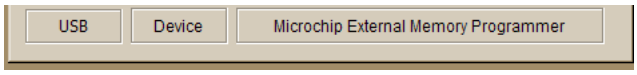
Upload Progress

The upload progress is a graphical status of the communication when programming or verifying the device.

4.5 Communication Medium Information

The communication medium information displays the type of medium used, serial or USB and other details that relate to the medium being used. For serial communication, the communication port (COMM) will be displayed and the baud rate, data bits, parity and stop bits. For USB communication, the devices manufacturer and product strings are displayed.





Communication Medium

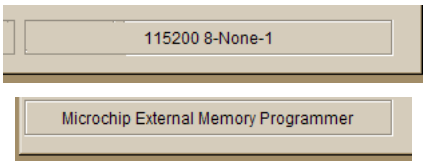
The type of medium used for communication, either serial or USB.

Communication Interface

For serial communication, the serial port (COMM<x>) will be displayed.

For USB communication "Device" will be displayed.

Communication Settings/Information



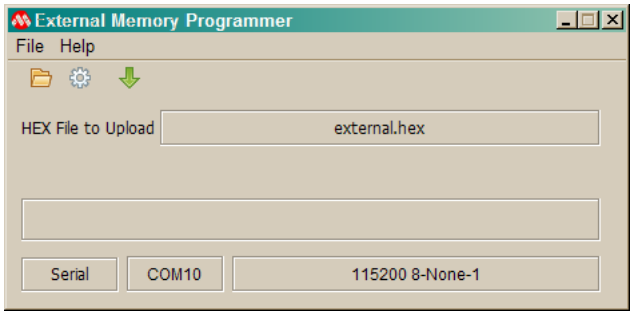
For serial communication, the baud rate, data bits, parity and the stop bits will be displayed.

For USB communication, the product string will be displayed.

5 Using the Utility

5.1 Loading a HEX file

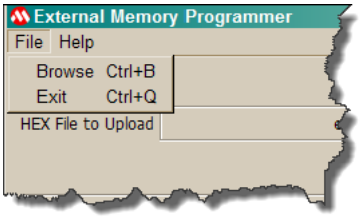
Loading a HEX file to upload to a device can be done two ways, through a file dialog box or dragging and dropping it.

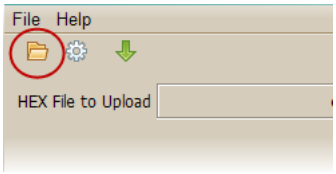


Loading a HEX file from a File Dialog Box

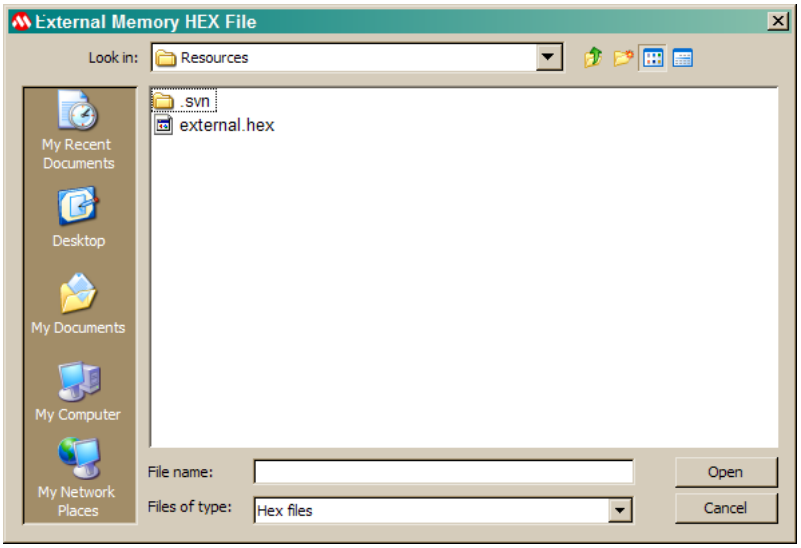
Follow these steps to load a HEX file from a file dialog box

1. Launch a file dialog by either choosing the Browse menu option or tool bar button.

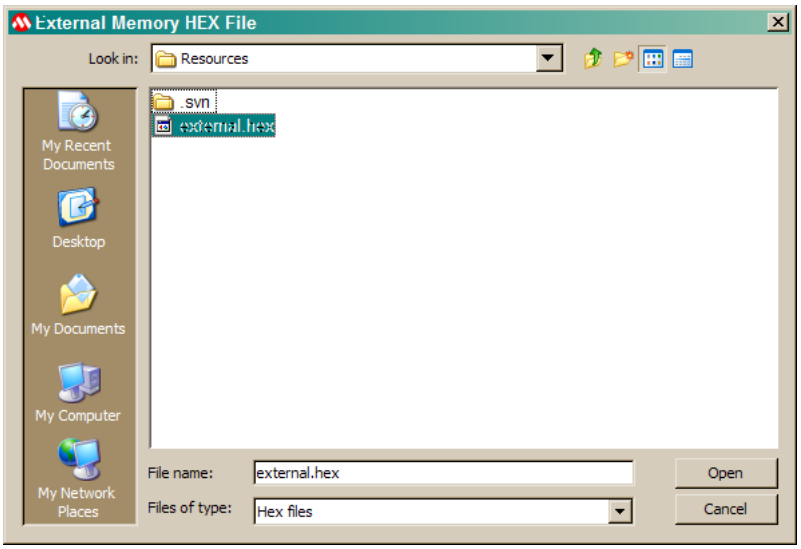




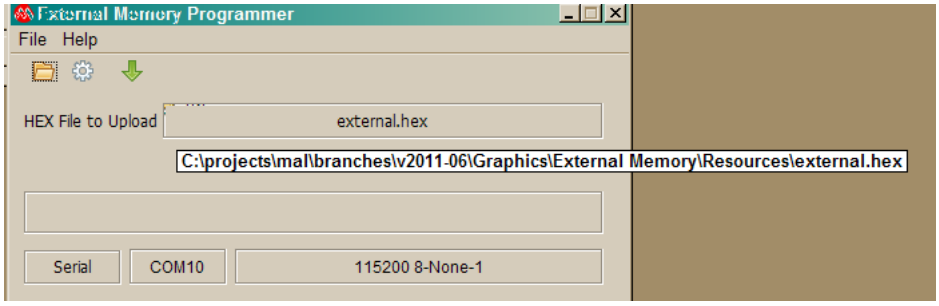
2. Use the file dialog box to navigate to the HEX file directory



3. Select the HEX file to load



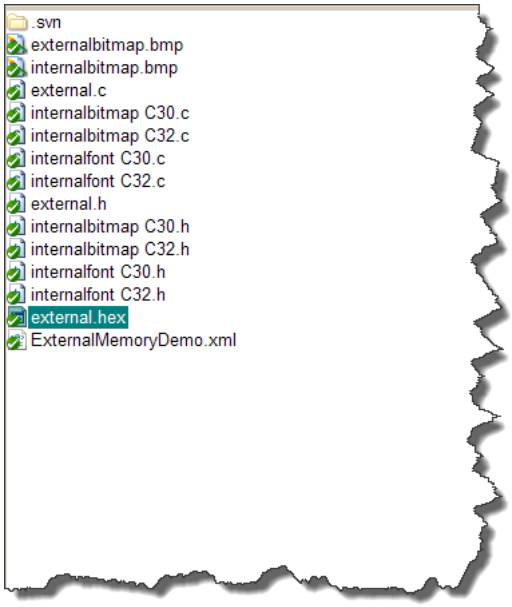
4. The HEX file name will appear in the HEX File to Upload box, hovering over the box will show the absolute path.



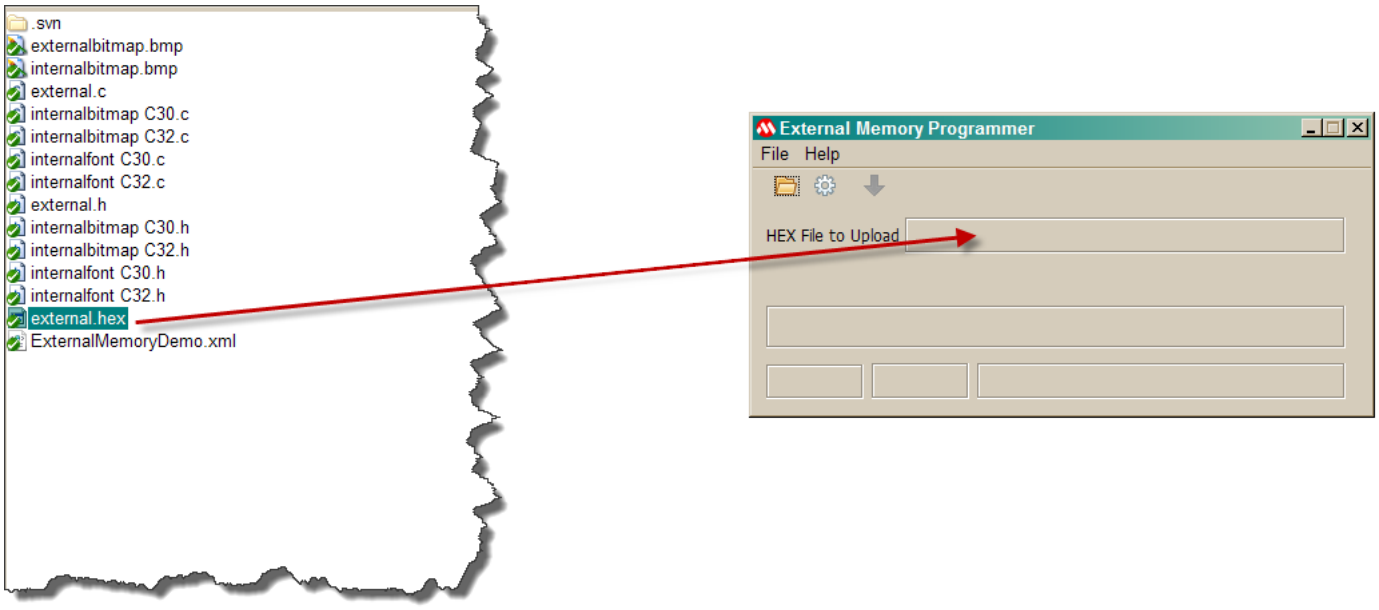
Loading a HEX File by drag and drop

Follow these steps to load a HEX file by drag and drop

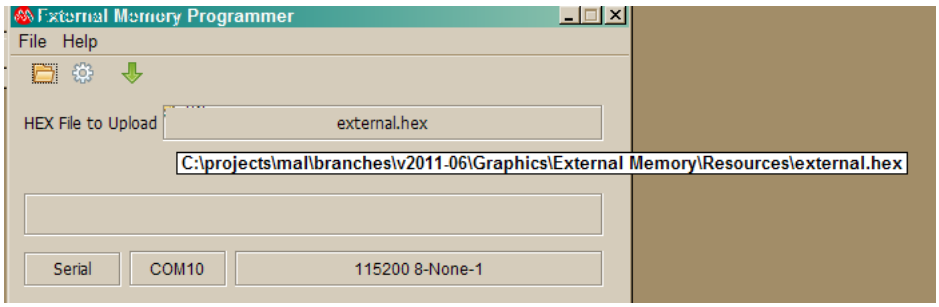
1. Navigate to the directory or location of the HEX file.



2. Drag the file, by using the drag feature, to the HEX File to Upload box and drop it.



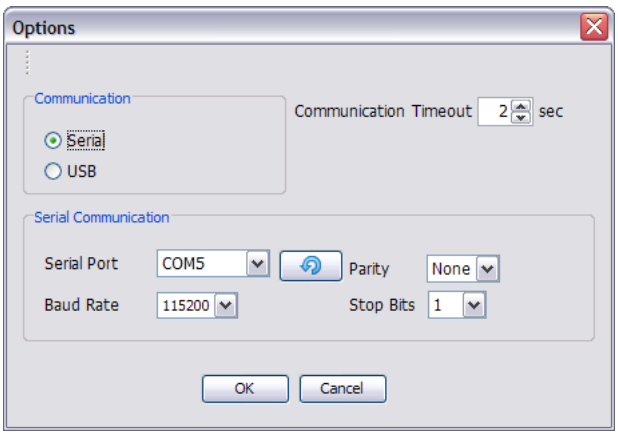
3. The HEX file name will appear in the HEX File to Upload box, hovering over the box will show the absolute path.



5.2 Setting the Communication Parameters

Setting the communication medium and parameters can be done with the Options dialog box. The dialog handles setting the serial and USB communication parameters.

Serial Communication Settings

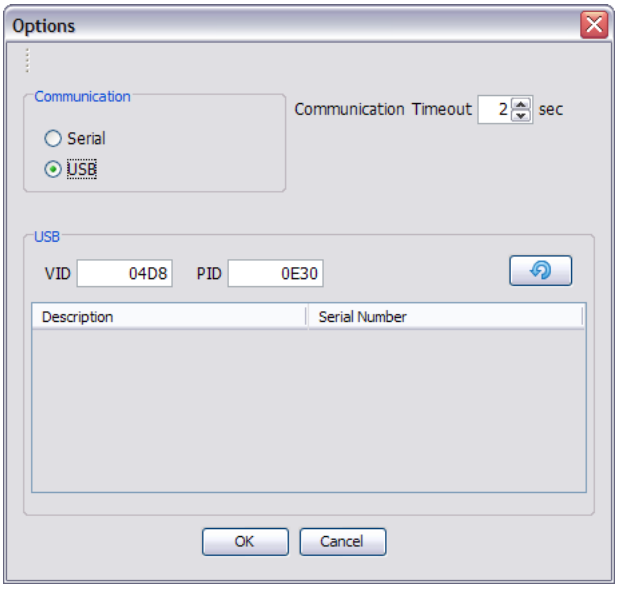


Follow these steps to configure the serial communication parameters

1. Select the serial port. The drop down combo box will be populated with all of the serial ports that are available.
    1. The refresh button can be used to "refresh" the available serial ports.
2. Select the baud rate.*
3. Select the parity.*
4. Select the stop bits.
5. Set the communication timeout.

* It is important that the device has the same settings for proper communication.

USB Communication Settings



Follow these steps to configure the USB communication parameters

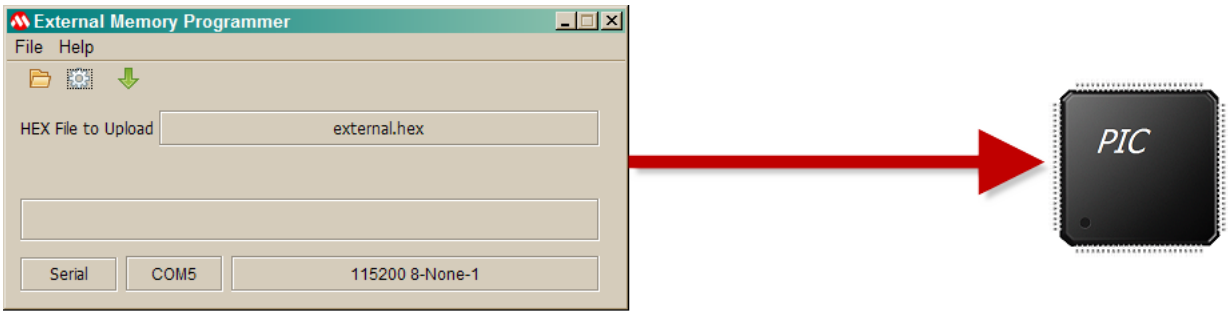
1. Plug in the USB device into the host PC running the External Memory Programmer.
    1. The host PC may require a driver and *.inf file to be associated with the USB device. Please refer the the USB driver section for more information.
2. Select the USB radial button.
3. The user can select the VID and/or PID of the USB device.
    1. After changing the VID or PID, the user must refresh the table, by pressing the refresh button.
    2. If the PID is left blank, then all USB devices that make the VID will populate the table
4. Select the serial number corresponding to the USB device to upload.
5. Set the communication timeout.

After the communication method has been configured, the information will be displayed on the main panel.

5.3 Uploading a HEX file

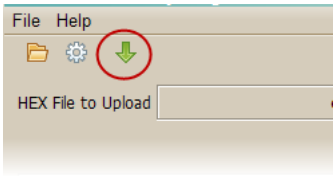
After selecting the HEX file to upload and configuring the communication method, the programmer will enable uploading to a device.

Uploading a HEX file to a device

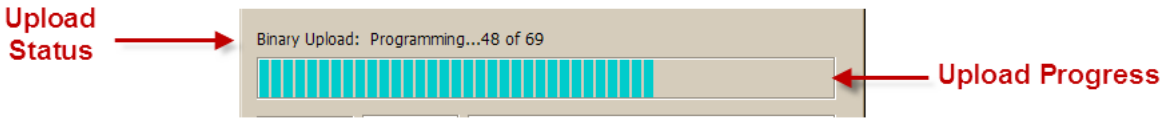


Follow these steps to upload a HEX file to a device

1. Make sure that the device is properly connected to the host.
2. Select a HEX file and configure the communication method
3. The upload button will be enabled.
4. Press the upload button



5. The upload status and progress bar will display the current progress of the upload



6. A message box will appear at the end of a successful upload indicating the time to upload.

5.4 Command Line Interface

The External Memory Programmer can be run through a command line interface. Passing arguments will determine if the GUI is launched or the command line interface is used.

To run the External Memory Programmer GUI from the command line:

```
>java -jar "<MLA directory>/Microchip/Graphics/bin/memory_programmer/memory_programmer.jar"
```

To run the External Memory Programmer from the command line without launching the GUI:

```
>java -jar "<MLA directory>/Microchip/Graphics/bin/memory_programmer/memory_programmer.jar"
<options>
```

where <options> are the command line options.

Here is an example of some command line interface:

```
>java -jar "<MLA directory>/Microchip/Graphics/bin/memory_programmer/memory_programmer.jar"
-I"input_file.hex" -C USB -PID 0xE30 -VID 0x4D8 -SN "mydevice"
```

5.4.1 Command Line Options

All command line options and associated values must be separated by a space. If the value of the argument contains a space, it must be surrounded by quotes.

Input File (-I)

The input file to upload to the firmware. This file must be Intel HEX format.

Communication Medium (-C)

The type of communication medium used.

Options:

USB - USB Communication

SERIAL - Serial Communicaiton

USB Serial Number (-SN)

The serial number of the USB device. This is the serial number that is passed from the descriptor. The communication medium selected needs to be USB for this argument to be valid.

USB Product ID (PID) (-PID)

The USB Product ID of the USB device. This is the PID from the descriptor. The communication medium selected needs to be USB for this argument to be valid.

USB Vendor ID (VID) (-VID)

The USB Vendor ID for the USB devices. This is the VID from the descriptor. The communication medium selected needs to be USB for this argument to be valid.

Serial Port (-SP)

The serial communication port that will be used. The port used should be passed as COM<x>, where <x> is the serial port number. The communication medium selected needs to be serial for this argument to be valid.

Serial Baud Rate (-BR)

The serial baud rate used by the communication port. The communication medium selected needs to be serial for this argument to be valid.

Serial Parity (-P)

The serial parity of the communication settings. The communication medium selected needs to be serial for this argument to be valid.

Serial Stop Bits (-SB)

The serial stop bits, 1, 1.5 or 2, for the communication settings. The communication medium selected needs to be serial for this argument to be valid.

An example of serial communication:

input file: example.hex

COM port: 2

115200-8-N-1

```
>java -jar "<MLA directory>/Microchip/Graphics/bin/memory_programmer/memory_programmer.jar"
-I "example.hex" -C SERIAL -SP COM2 -BR 115200 -P None -S 1
```

An example of USB communication:

VID: 0x4D8

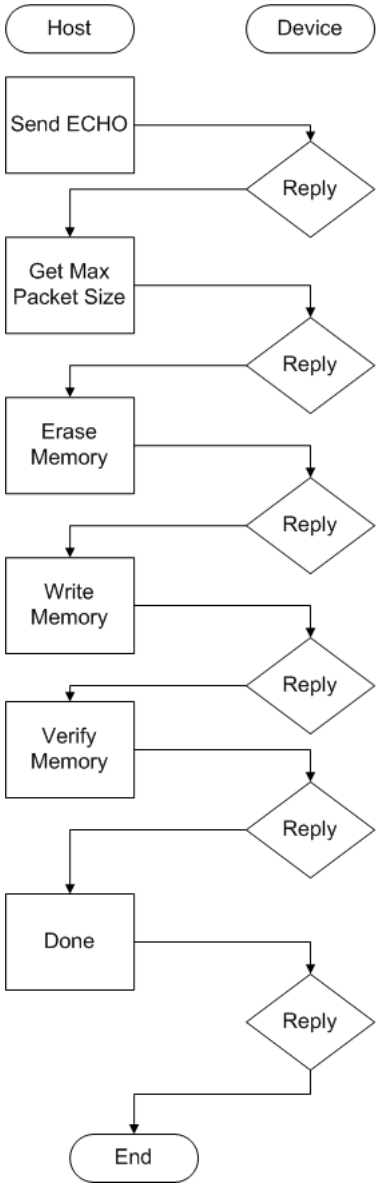
PID: 0xE30

Serial Number: usb example

```
>java -jar "<MLA directory>/Microchip/Graphics/bin/memory_programmer/memory_programmer.jar"
-I "example.hex" -C USB -PID 0xE30 -VID 0x4D8 -SN "usb example"
```

6 Binary Communication Protocol

The External Memory Programmer uses an ACK/NACK communication method to transfer the data contained in the HEX file to the device. All packets from the host to device must be ACK/NACKed, but do not require a payload.

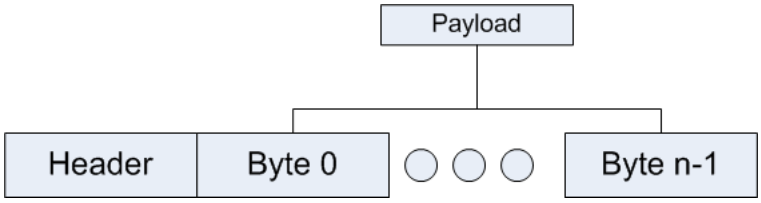


The following is a description of the communication method with uploading a HEX file.

1. An echo packet is sent. This packet has no payload and is used to establish communication between the host and device.
2. A packet requesting the maximum packet size is sent. This is used by the host to ensure that the packet length is never larger than the device's resources. Devices are able to dictate the resource requirements for the packet.
3. A packet requesting that the memory be erased. The device will need to make sure that the memory is in the proper state to write data.
4. The memory write packets are sent. The amount of packets required depend on the HEX file and the maximum packet size.
5. The verify memory packets are sent. The device will perform a checksum over a memory region.
6. The done packet will be sent. The device is notified that all memory uploading and verifying are complete.

6.1 Binary Packet

The binary packets used in the External Memory consist of a header followed by a payload. The payload size can range from 0 to 65,000 bytes. The payload size is determined by the device.



Packet Header

The packet header is four bytes in length.

ACK.NACK (1 bit)	Reply (1 bit)	Command (6-bits)	Checksum (8-bits)	Length (16-bits)

ACK/NACK - This bit is a response to a command and the reply bit must be set.

Reply - This bit is set when a response to a command is processed. Every command packet must have a reply

Command - The command of the packet. All reply packets will reply with the same command.

Checksum - The checksum of the entire packet. If the calculated checksum does not match the header's checksum, the packet must be NACKed.

Length - The length of the payload, ranging from 0 - 65,000.

Packet Payload

The packet payload is variable length. The length member of the header will indicate the size of the payload in bytes.

6.2 Binary Commands

The binary packets use commands to instruct the device what actions are required.

The following commands are supported by the External Memory Programmer

- **ECHO** - A zero payload command. Used to establish communication with a device.
- **MEMORY ERASE** - requesting that the memory be prepared to be written to.
- **MEMORY WRITE** - write the data in the payload to a memory section
- **MAX PAYLOAD SIZE** - requesting the maximum payload size accepted by the device
- **MEMORY VERIFY** - requesting a checksum over a memory range
- **DONE** - all memory programming and verifying are done

7 USB Drivers

The External Memory Programmer provides two communication mediums to upload HEX files, serial and USB. The MAL provides the serial communication drivers needed for Windows and MAC operating systems.

The following drivers and files are needed to run use the USB medium.

- The inf file, MPLABCommWinUSB.inf, is provided by the <install directory>/Microchip/Utilities/USB Drivers/MPLABComm/Windows directory.
- The USB drivers are located in the <install directory>/Microchip/Utilities/USB Drivers/MPLABComm/ directory.

8 Trouble Shooting

The following topics may be helpful when debugging the External Memory Programmer.

Why doesn't the External Memory Programmer run when a double click on the memory_programmer.jar?

1. Make sure that you have JRE 6 or higher installed on the host machine.
2. Make sure that the JRE is associated with the jar extension.

Why can't I find the available serial port I need?

Make sure that you have the serial port available before selecting the communication settings. For example, if using a USB to serial connector, make sure it is plugged in and enumerated by the host before selecting the communication settings.

Why doesn't the HEX file load with a select upload with serial communication?

1. Make sure that the settings of the External Memory Programmer match the settings of the device.
2. Make sure that the serial cable is correctly connected.

When running on a MAC, why do I see a "Port in Use Error" error?

When running the application on a MAC, the serial libraries need to have permission to lock the serial port. Without this permission, the library assumes that the serial port is in use by another application. If you are not certain that the serial library has lock permission, see the MAC: Lock File Permission section for details on how to accomplish this.

Why can't I choose a serial port?

If the application's serial port selection window is disabled, the serial libraries where unable to be loaded.

- Make sure that the memory_programmer.jar is located at the same directory level as the Serial Drivers directory.
- Linux operating systems are not supported at this time.

Why can't the USB device be selected?

1. Make sure that the device is enumerated. See USB Drivers for more information.
2. Make sure that the device has the proper USB product and vender ID. See the USB descriptor of a MAL graphics demo External Memory for an example of the proper product and vender ID.
3. Make sure that you have USB serial number. If using multiple devices, use a unique USB serial number for each device.

What if I lose communication with my target device?

If communication is lost, there is a timeout of 1.5 seconds along with a retry counter of 3. The communication status will show the retry count.

9 MAC: Lock File Permission

When using serial port communication on a MAC OS, the serial library used by the memory_programmer needs to be able to lock the serial port. By locking the serial port, no other application will be able to access the serial port while the memory_programmer is using it. For the reason, the memory_programmer must has permission by the MAC operating system to be able to lock files.

Here are the following steps that can be preformed in the command line interface to grant lock permission to memory programmer.

1. Make /var/spool/uucp and /var/lock directories if they do not exist.

```
sudo mkdir /var/spool/uucp
sudo mcdir /var/lock
```

2. Change the permission and group of the made directories

```
sudo chmod 775 /var/spool/uucp
sudo chmod 775 /var/lock
sudo chgrp uucp /var/spool/uucp
sudo chgrp uucp /var/lock
```

3. Confirm the permission and group of the made directories. The output is shown if operation is correct.

```
ls -l /var/spool/ | grep uucp
>drwxrwxr-x 2_uucp_uucp 68 5 19 03:15 uucp

ls - /var/ | grep lock
>drwxrwxr-x 20 root_uucp 680 10 7 14:26 lock
```

4. Confirm the USER ID. You USER ID is shown as taro.

```
who -H am i
>USER_LINE    WHEN
>taro    ttys000 Oct 7 15:28
```

5. Append your account to the membership of the UUCP group. Please user your own USER ID for taro.
   1. For MAC OS 10.4

      ```
      sudo niutil -appendprop / /groups/uucp users taro
      ```

   2. For MAC OS 10.5 or 10.6

      ```
      sudo dscl . -append /Groups/uucp GroupMembership taro
      ```

6. Confirm the setting of the UUCP group, where taro is the USER ID.

```
dscl . -read /Groups/uucp | grep GroupMembership
> GroupMembership: taro
```

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